



ACT 234

Hawaii's Global Warming Solutions Law

Work Plans for Reducing GHG Emissions

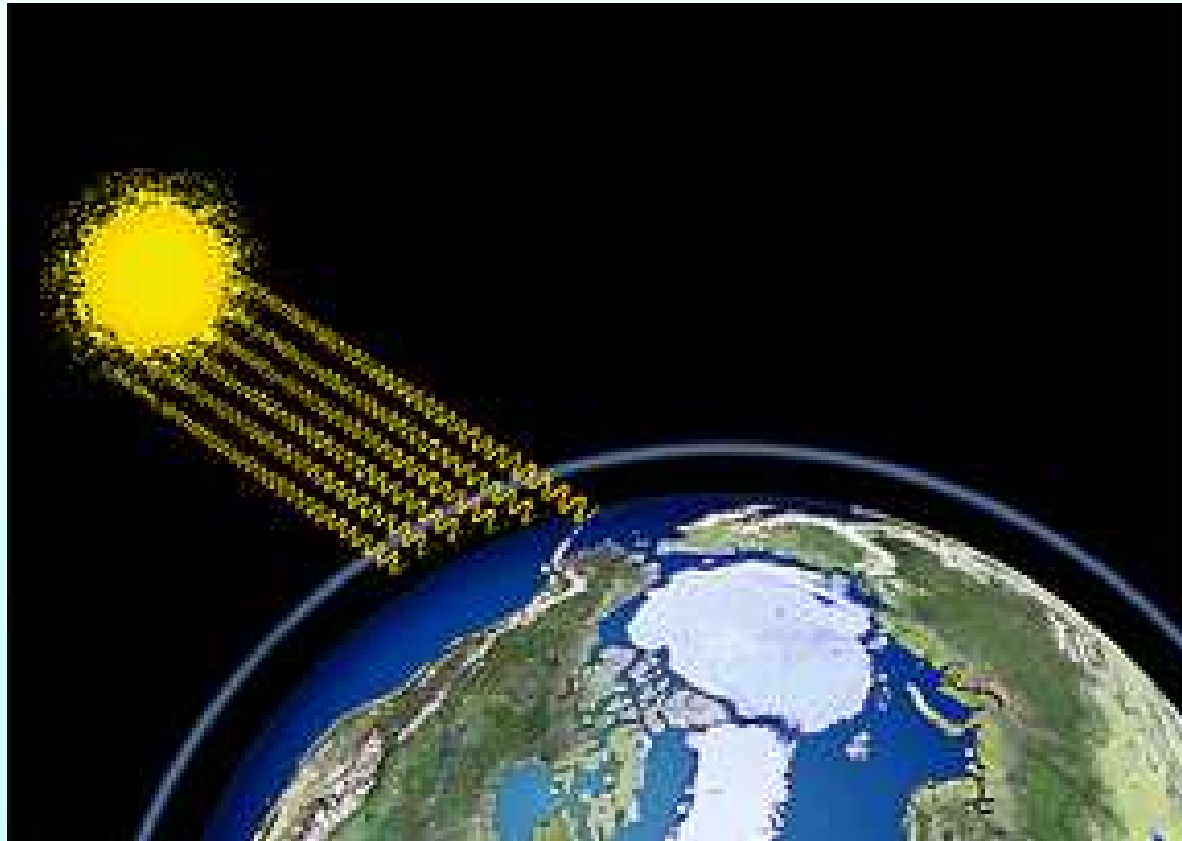
**Greenhouse Gas Emission Reduction Task Force
Public Workshops**

November 2009



Current Science, Law, and Action

Greenhouse gases trap heat from the sun in the atmosphere. More gases lead to extra warming, climate changes, and problems.



Greenhouse Gases

Carbon Dioxide (CO₂): gasoline and electric power

Methane (CH₄): landfills & livestock

Nitrous Oxide (N₂O): fossil fuel & biomass burning, fertilizer use



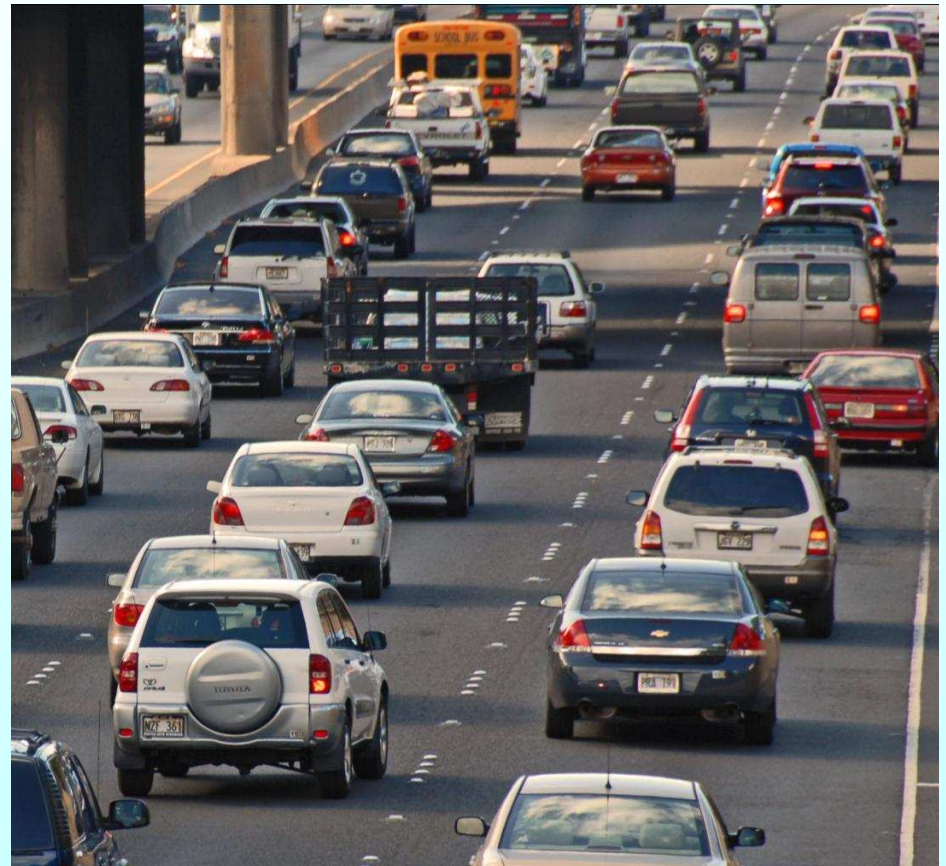
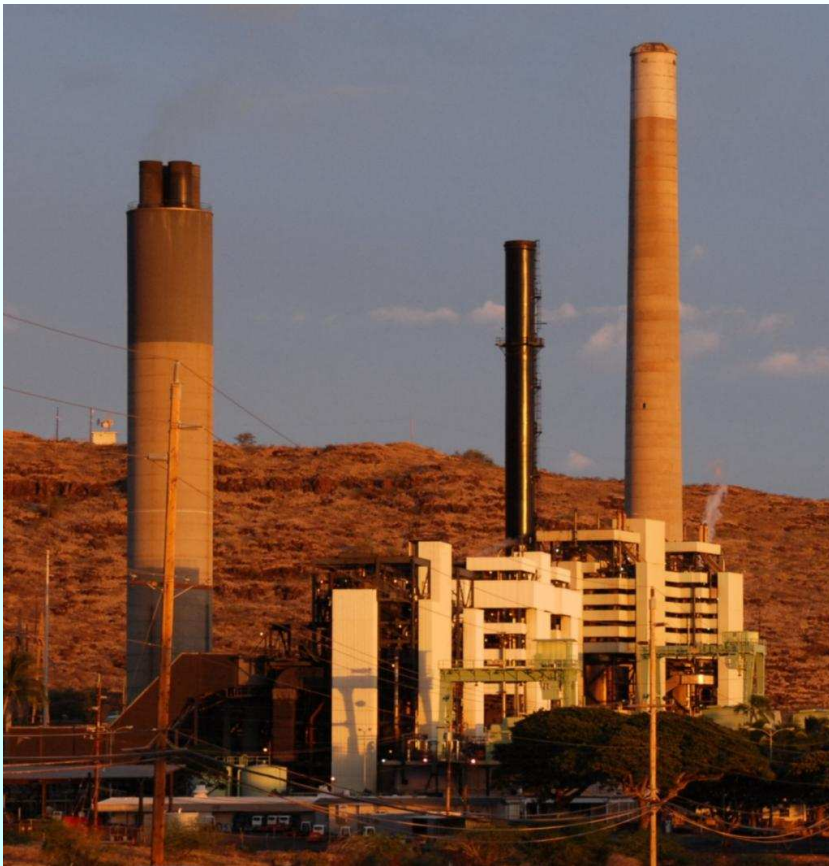
Others:

Perfluorocarbons (PFC),
Hydrofluorocarbons (HFC),
Sulfur Hexafluoride (SF₆)

Kilauea volcano emits
sulfur dioxide

•not a greenhouse gas

**Each Hawaii resident contributes
over 17 tons GHG per person**



Our everyday contribution to a changing climate

- **1 gallon of gasoline = about 20 pounds GHG**
- **Typical car = about 1 pound GHG per mile
= about 4 tons GHG per year**
- **1 kilowatt-hour of electricity = about 2 pounds GHG**
- **Average HI home = about 7.5 tons GHG per year**

GHG rise expected to cause or intensify in Hawaii:

- **Sea level rise**
 - **Shore erosion**
 - **Poor drainage**
 - **Saltier groundwater**
- **Sea more acidic**
- **Sea surface warmer**
- **Reefs, shellfish weaken**



Expected Hawaii Changes cont'd

- **Weather**
 - Rain, temperature, wind
 - More frequent and severe storms
 - Drought
- **Water supply**
- **Forest & crop changes, habitat loss**
- **Spread of diseases**
- **Health effects**

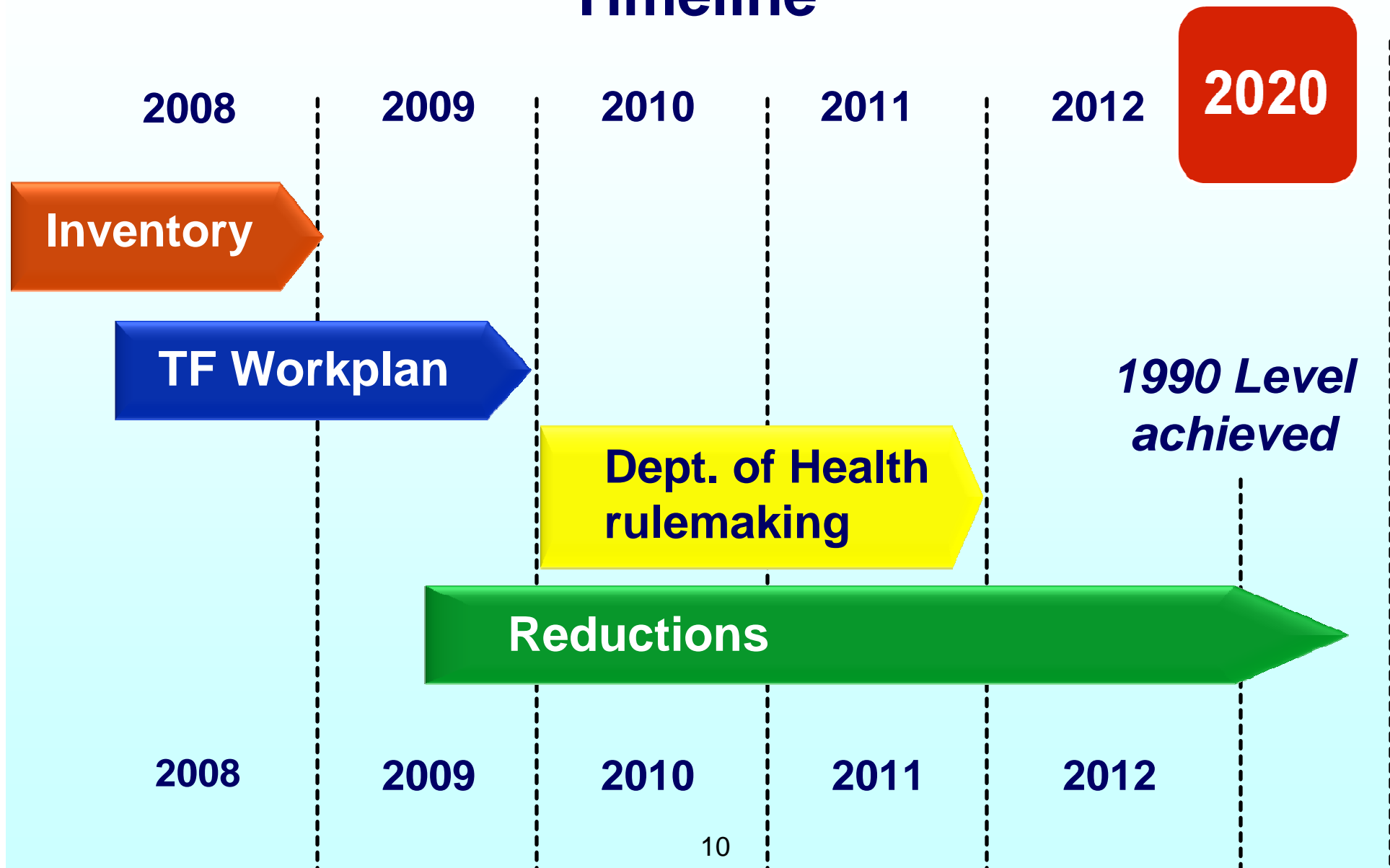


Act 234 Target:

GHG Emissions to 1990 Levels by 2020

- **About 12% reduction from 2007**
 - **1990: 13,660 kt CO₂e (carbon dioxide equivalent)**
 - **2007: 15,487 kt CO₂e**
- excludes** aviation & international fuels
- includes** carbon “sinks” (*e.g. forests, reservoir GHG for indefinite period*)

Global Warming Solutions Act 234 Timeline

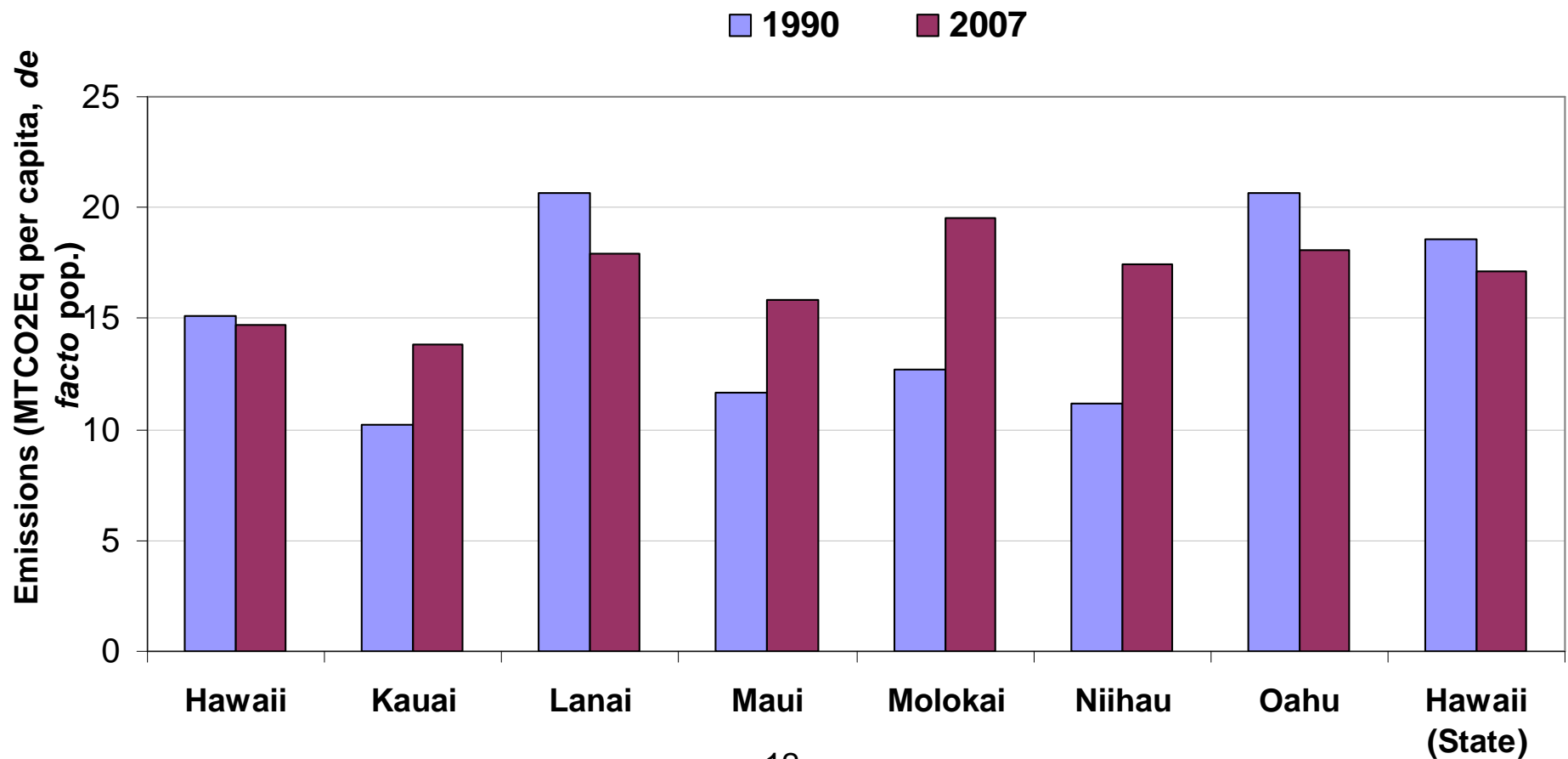


Inventory: Sources

- **Energy 90%** (2007, in MMTCO₂e)
 - Electricity: 8.75 MMTCO₂e
 - Transport:
7.75 MMTCO₂e w/o Aviation, (**12.58 w/ aviation**)
 - Ground – passenger: 3.37 MMTCO₂e
 - Ground – freight: 1.40 MMTCO₂e
 - Marine: 2.17 MMTCO₂e
 - Aviation: **4.83 MMTCO₂e**
- **Industrial Processes:** 0.68 MMTCO₂e (w/o com, res)
- **Waste:** 1.03 MMTCO₂e
- **Agriculture, Forestry, and Other Land Use:**
-2.27 MMTCO₂e

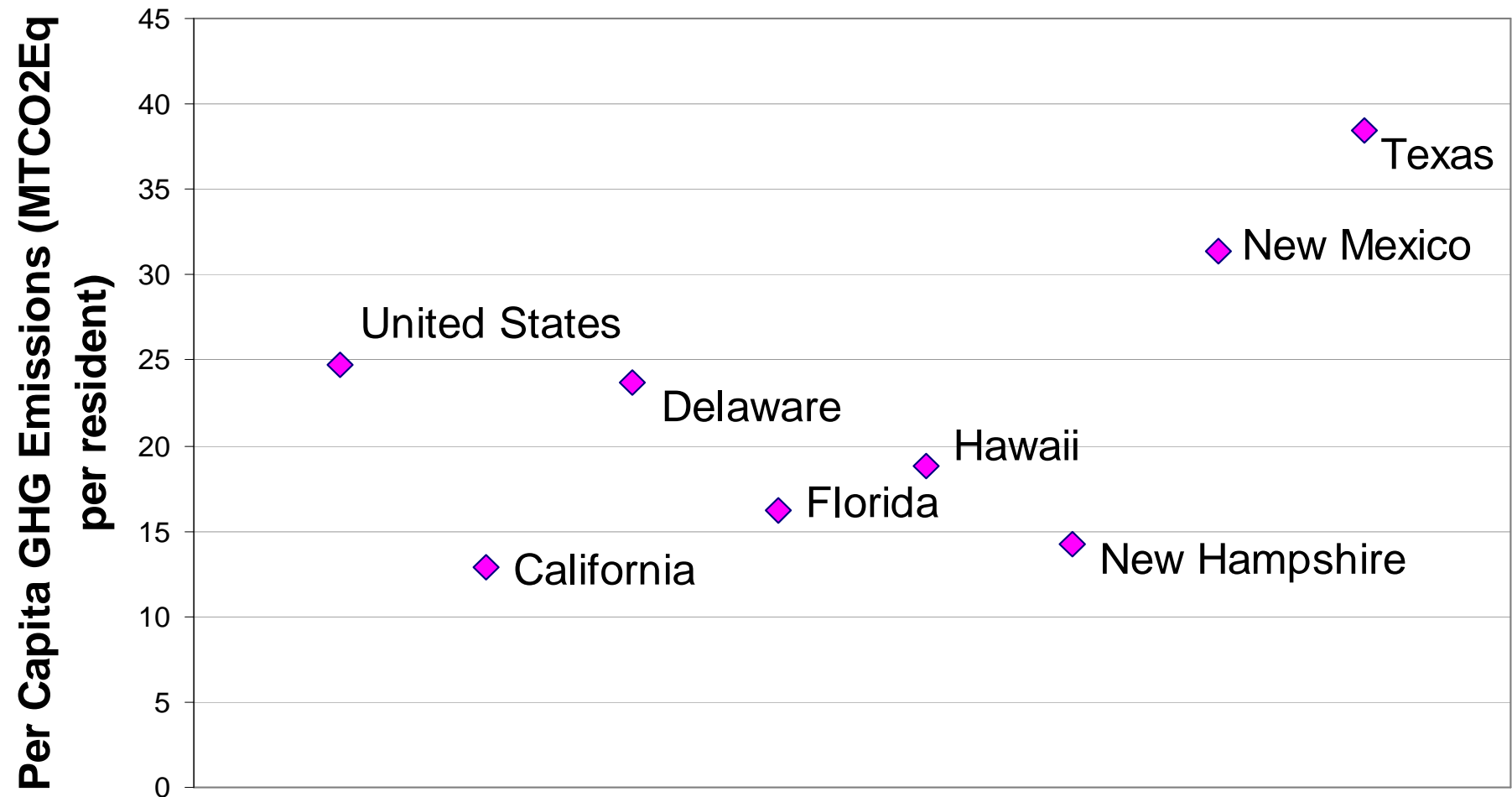
Emissions in Context: Trends Per Person, by Island

Hawaii Per Capita GHG Emissions by Island, 1990 & 2007

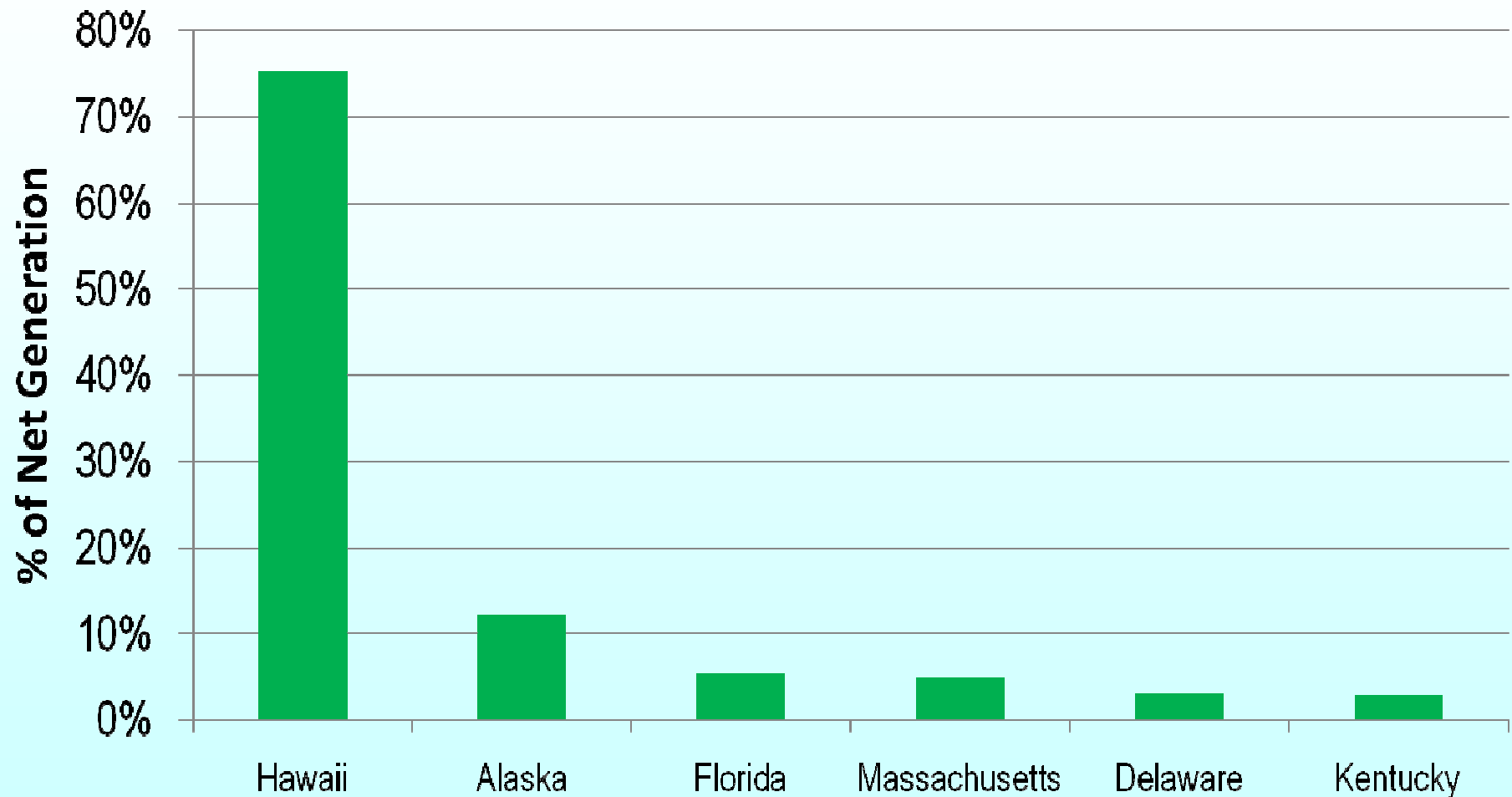


Emissions per person: Selected States

Comparison of Hawaii Per Capita GHG Emissions with Selected States
(1990)



Petroleum Dependence for Electricity: Top 6 States



Source: EIA-923 and EIA-860, December 2008

We send up to \$7 billion a year out of our economy.



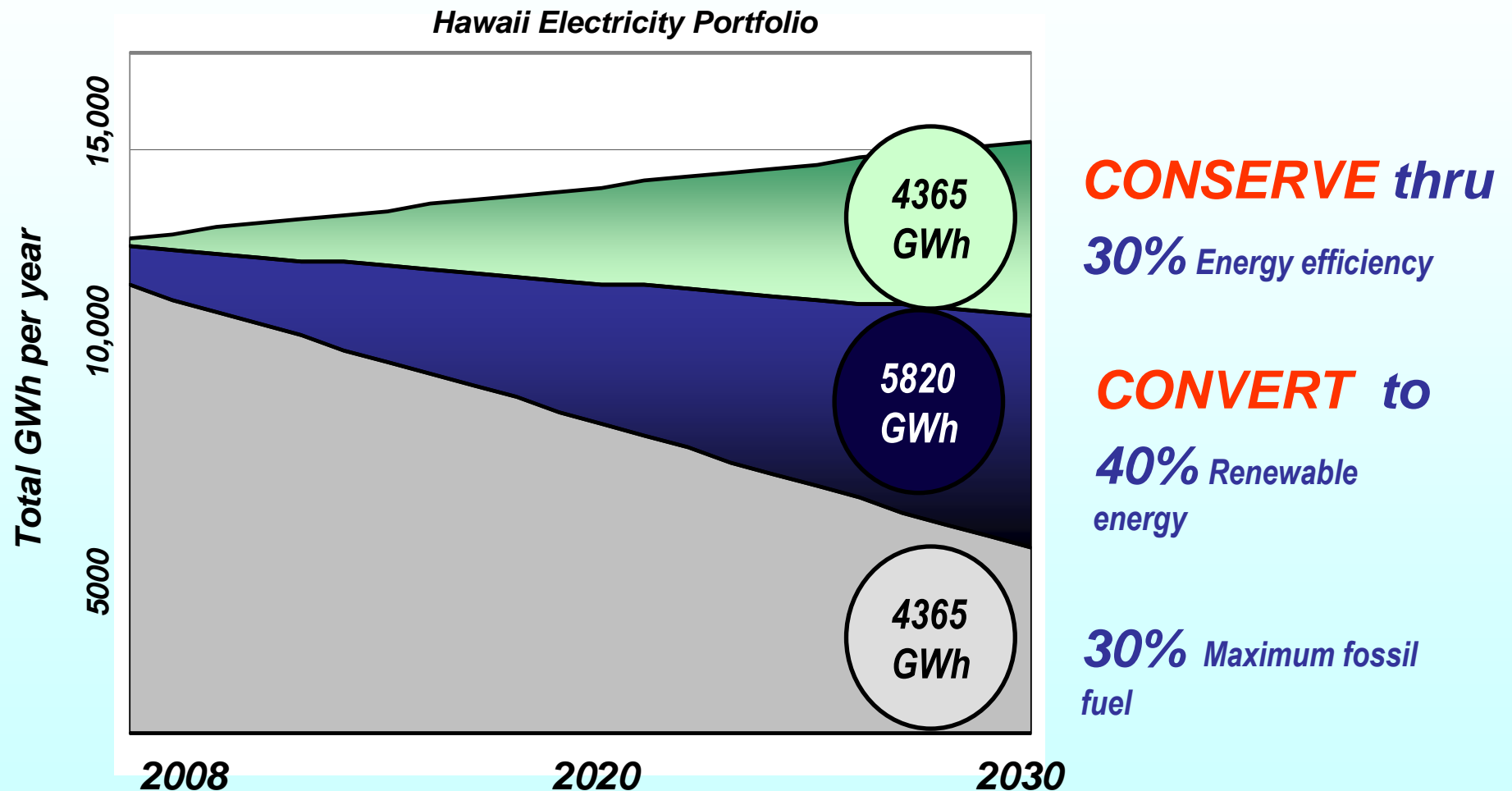
Hawaii Clean Energy Initiative

National Partnership to Accelerate System Transformation

Goals:

- *70% clean energy economy within a generation*
- *Increase Hawaii's security*
- *Economic benefits for all levels of society*
- *Foster and show innovation*
- *Build the workforce of the future*
- *Be a model for the US and the world*

To reach 70% clean energy by 2030 make it easy to Conserve and Convert



HCEI: accomplishments so far

- **Partnerships: 100+ citizens & experts**
- **Agreement with HECO for big changes**
- **Partnered with electric car companies**
- **Significant efficiency projects across the state**



Hawaii Greenhouse Gas Emissions Reduction

Work Plans

Summary of Work Plan Report

- **Target: 1990 emissions levels by 2020**
excludes aviation & international fuels, includes sinks
- **Reference Case hits target *if all items met on time*;**
includes existing laws & policies.
- **All 3 work plans *include* Hawaii Clean Energy Initiative plus other policies (HCEI+).**
- **HCEI+ & all work plans, *if met on time*, reduce emissions about 39% below target.**

Reference Case – Highlights

- ‘Business as usual’ projection
- Population growth ~1.1% per year
- Economy increase ~2.3% per year (Gross Regional Product or GRP)
- Lower energy use per household and per \$ output
 - Increased efficiency
- GHG emissions decline slightly (-1.3% per year)
 - Increased efficiency and renewable energy use.
- Highway & power emissions decline as a share of total.

Work Plans' Background

- Act 234 requires certain considerations, excludes aviation
- Assumptions, information, & models are key:
 - energy prices (AEO 2009)
 - economic forecasts (DBEDT 2035 Series)
 - population forecasts (DBEDT 2035 Series)
 - state energy use model ('ENERGY 2020')
 - economic impacts model ('REMI')
- Emissions changes for each policy are only estimates
 - do not account for interactions between policies.*



GHG Reduction Policies Included in Work Plans

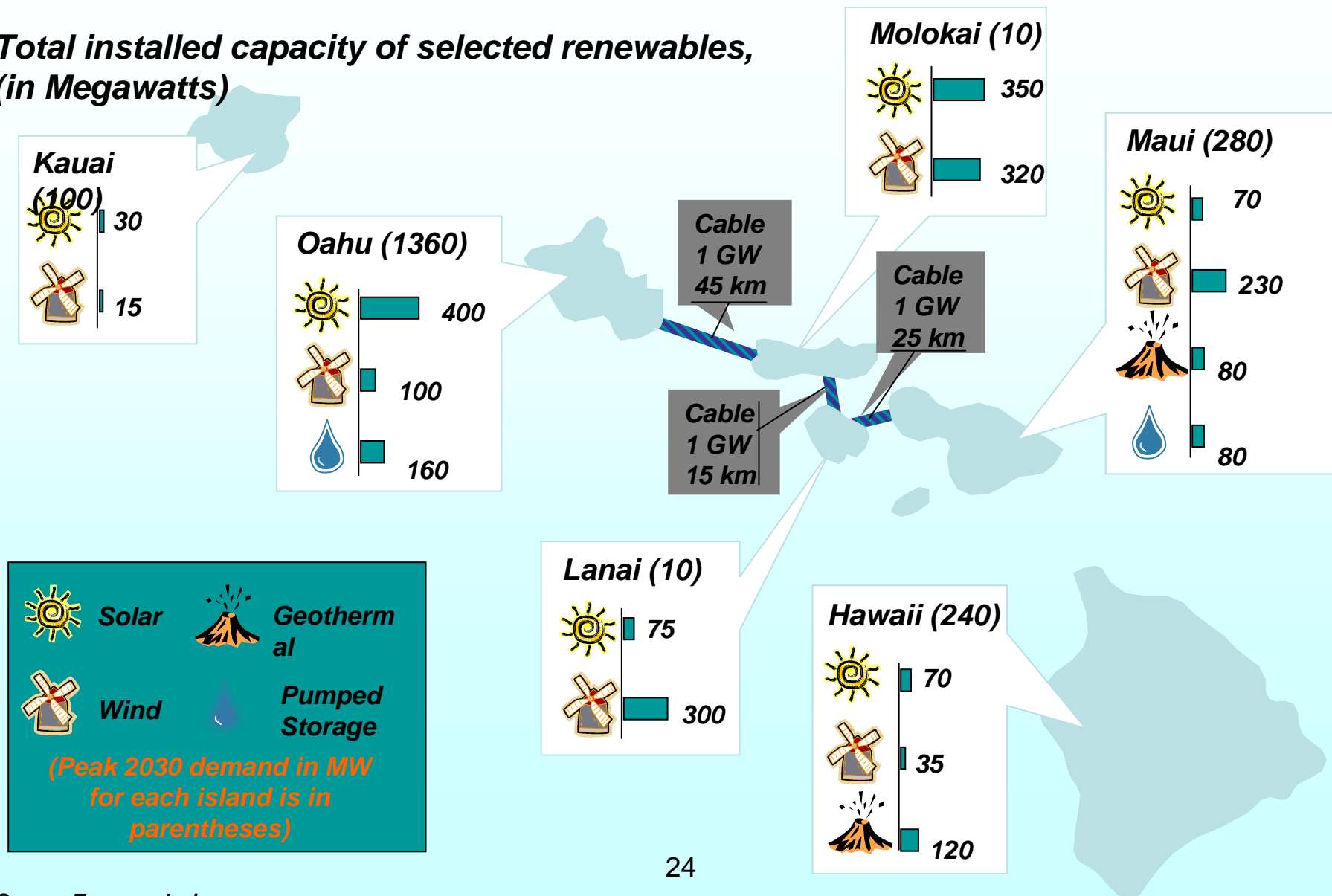
Work Plan 1: HCEI + Additional Policies

	Policy	Description	CO2e Reduction in 2020 (estimated, & when done alone)
HCEI			
	More Renewable Generation & Biofuels for Power Plants	per HCEI Energy Agreement	4,490 kt Renewable Generation
	Sea Water Cooling	2 projects- Waikiki/Honolulu	126 kt
	Plug in Hybrid Electric Vehicles (PHEV's)	2010 start – to 2% of new vehicles by 2020	56 kt
Additional Policies			
	Renewable Portfolio Standard (RPS) now Act 155/2009	25% electricity sales by 2020 (5% above Reference Case)	244 kt
	Energy Efficiency Portfolio Standard (EEPS) now Act 155/2009	20% reduction by 2020	1,580 kt
	Increased New Vehicle Efficiency	35.5 mpg avg. in 2016 to 42.4 mpg by 2020	27 kt
	Building Codes	2010- 30% over current 2014- 50% over current then +5% every 3 years	715 kt

Note- Freight options and Land Use Planning recommended but not included in modeling.

Major HCEI Renewable Energy prospects, in 2030

Total installed capacity of selected renewables,
(in Megawatts)



Examples of Major HCEI Renewable Energy Projects

Project	Description	<i>Estimated Completion Target</i>
Wind Farms, Lanai	200 MW renewable energy each	2013
Wind Farm, Molokai	200 MW renewable energy	2013
Undersea cable	Lanai, Molokai, Oahu (Maui possibly, later)	2013
Other Projects (for all HECO companies)	169 MW (non-utility) 308 MW (utility-owned)	2020 2015 (including biofuels)

Work Plan 1: HCEI + Additional Policies

- Large emission reductions, if met on time
- Most reductions from HCEI & electricity efficiency (EEPS)
- Renewable (RPS), alternative fuel (AFS), & vehicle standards - relatively small effects through 2020
 - Most items already in Reference Case.
- Stronger effects after 2020:
 - Building code updates
 - PHEV's (plug in hybrid electric vehicles)
 - Land uses (Urban Form/Smart Growth

Work Plan 2: State Carbon Tax + HCEI+

- **State tax, not federal**
- **\$10/tonne in 2010 to \$40/tonne CO₂e by 2020.**
- **Emissions depend on tax & relative energy efficiency.**
- **Assumes HCEI+ is met on time.**
 - **covers carbon content of each fossil fuel**
but excludes non-energy emissions or feedstocks
 - **price certainty, not compliance certainty**
 - **market imperfections apply as w/ other price signals**
 - **similar to permit prices likely from federal C&T**

Work Plan 2, Carbon Tax Modeling Results

- Emissions reduction small next to & because of HCEI+
(*<50 kt vs 4,800 kt CO₂e*)
- Revenue: ~\$200M (2010) to ~\$870M (2020) per year.
(*Approximate amount raised by a tax before return via tax system*)
- May finance HCEI+, energy efficiency, adaptation to climate change effects on infrastructure and environment.
- To reduce negative effects
 - Assumed return of 90% through tax system.
(*Scenarios of keeping 100%, other %s, NOT modeled*)
 - Could cut other taxes (revenue neutral),
 - Could help low income families and people.

Work Plan 3: Federal Cap & Trade + HCEI+

- *C&T = Total tons capped, cap declines over time; need permit to emit each ton; some permits free, some auctioned; can buy/sell permits.*
- Uses Waxman-Markey bill by 2009 House of Rep.
aka American Clean Energy & Security Act ACES
- Target: 17% below 2005 covered sectors by 2020
- Coverage:
 - ❖ 2012 - Electricity and Oil Refining, = ~90% Hawaii emissions
 - ❖ 2014 - Other Industries
 - ❖ 2016 - Gas Distribution Cos. & virtually all fossil fuel energy.
- Prices assumed: \$20/tonne (2012) to \$35/tonne (2020).

Work Plan 3, Cap & Trade Modeling Results

- Emissions reduction small next to & because of HCEI+
(~ 20 kt vs. 4,800 kt HCEI+ reduction).
- Net Hawaii cost of buying federal permits
~\$212 million in 2012,
~\$154 million in 2020 as emissions decline.
- Cost to HI = required - free permits
 - Required permits decrease
 - from ~18 Mt in 2012, to ~14 Mt CO₂e by 2020.
 - Free permits = 8.8 Mt + ~0.2 for refineries & coal plant.
- Net cost = about 0.2% of projected HI GRP in 2020

Work Plans Comparison

Electricity & energy prices & bills

Summary of Work Plan Impacts- Yr 2020 <i>(changes all from Reference Projection)</i>	Work Plan 1 (HCEI +)	Work Plan 2 (State Carbon Tax + HCEI+)	Work Plan 3 (Federal Cap & Trade + HCEI+)
Average home electricity bill	~20% decrease	~20% decrease	~20% decrease
Electricity prices	22-24% Increase	25-28% Increase	21-23% Increase
Other fossil fuel energy prices (incl. diesel, oil, bottled gas)	No change	5-6% Increase	7-8% Increase

- Consumer electricity costs decline despite price rise, as efficiency reduces use.
- Non-electricity costs (e.g. gasoline, food, etc.) likely to increase if fuel costs increase significantly (i.e., carbon tax, C&T)

Hawaii Economic Impact of Work Plans Comparison

Summary of Work Plan Impacts on Hawaii Economy- Yr 2020 <i>(changes all from Reference Projection)</i>	Work Plan 1 (HCEI +)	Work Plan 2 (State Carbon Tax + HCEI+)	Work Plan 3 (Federal Cap & Trade + HCEI+)
Gross Regional Product	0.3%	0.3%	0.9%
Real Disposable Income	0.4%	0.4%	1.1%
Total Population	0.1%	0.1%	0.6%
Total Employment	0.3%	0.4%	0.9%
Commercial Employment	0.2%	0.3%	0.8%
Industrial Employment	7.0%	7.0%	7.0%
Forestry & Agriculture Employment	0.0%	0.0%	2.3%
Utility Employment	-16.7%	-13.3%	-16.7%

Work Plans – Summary of Results

- Emission reductions do not vary much between plans.
- Most reduction is from Plan #1, HCEI+, if met on time.

Work Plans Summary cont'd

- **Plans #2 & 3:** some higher energy costs & economic effects, including **higher** costs for small businesses, compared to plan #1.
- **Plan #2** (Carbon Tax + HCEI+): stronger price signal & provides funds for State.
- **Plan #3** (C&T + HCEI+): Funds from Hawaii to federal system.
 - Net effect depends on Hawaii's share of “permit funded” program spending.

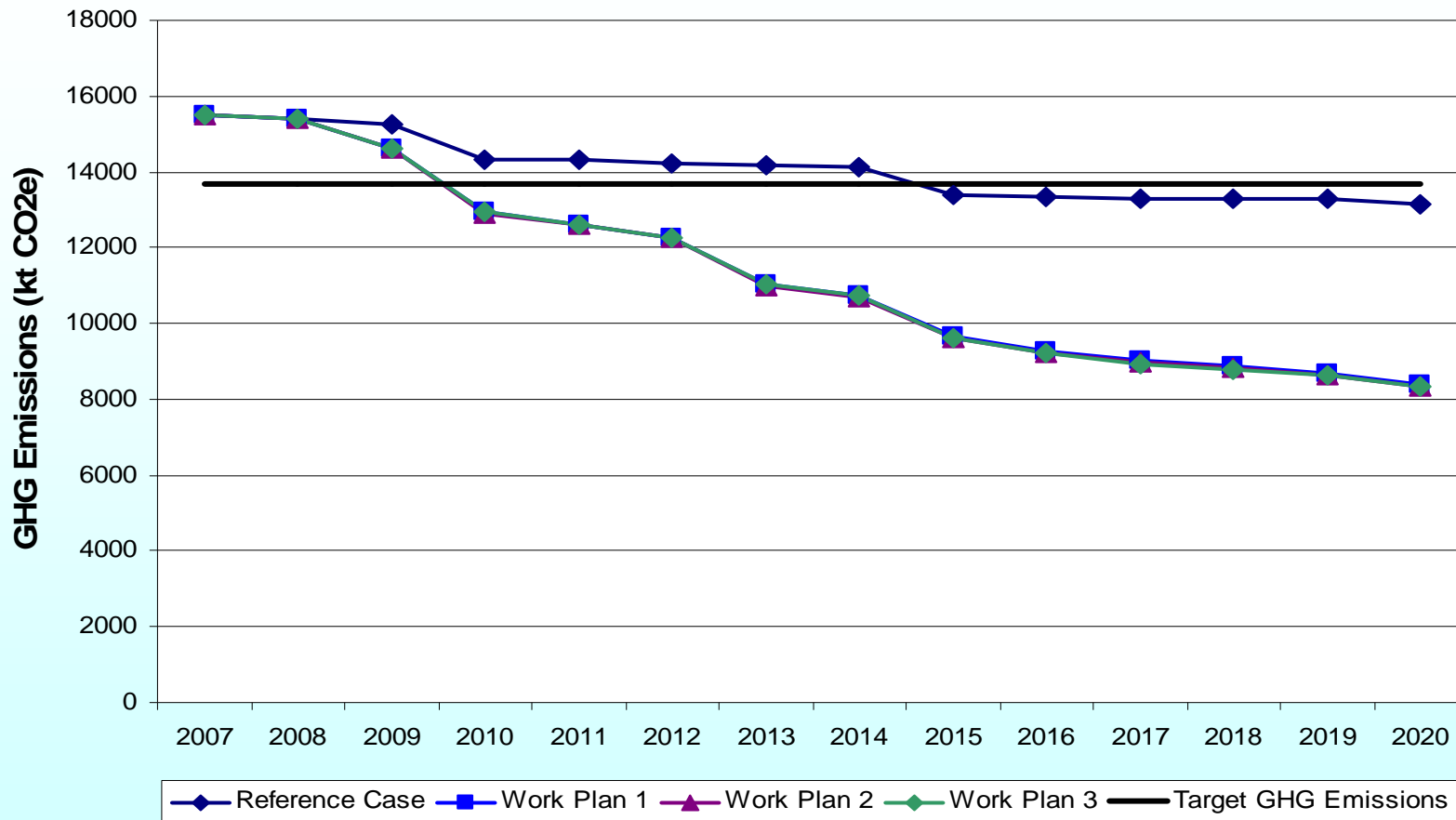
GHG Emissions Changes Under Work Plans

Target: 13,660 kt CO₂e

2007: 15,487 kt CO₂e

Work Plan or Case	Description	Emissions in 2020 (CO₂e)	Amount Below 1990 Target CO₂e	% Below 1990 Target Level
Work Plan 1	HCEI & added proposed policies are met on time	8,377 kt	5,280 kt	38.7%
Work Plan 2	State Carbon Tax used w/ Work Plan 1	8,327 kt	5,330 kt	39.0%
Work Plan 3	Federal Cap & Trade system used with Work Plan 1	8,324 kt	5,340 kt	39.1%
Reference Case	Existing laws & policies met on time	13,122 kt	538 kt	4.0%

Hawaii's Targeted GHG Emissions Under Work Plans



- 1) Graph includes all emissions. **All Work Plans, plus Reference case, meet Act 234 target.**
- 2) All work plan emissions fall far below reference case.
- 3) Differences between work plans are slight given the big differences from reference levels

Questions or Comments?

**Email comments by Dec. 1, 2009
for Task Force consideration**

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